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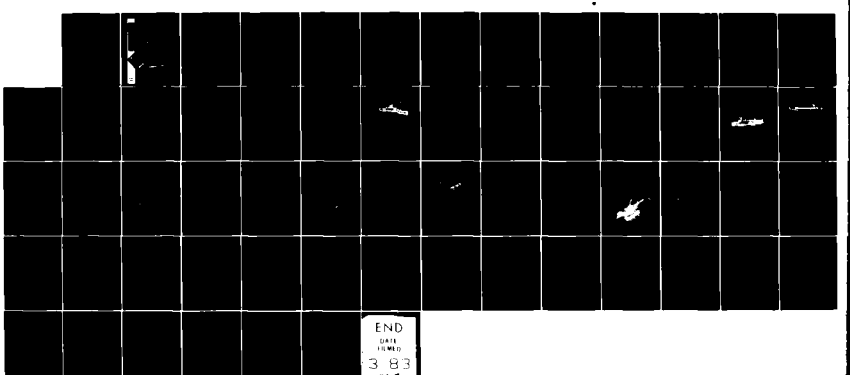

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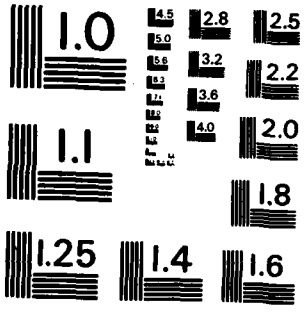

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LOGISTICS OVER THE SHORE

Do We Need It?

DAN J. BEAKEY

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LOGISTICS OVER THE SHORE

Do We Need It?

by

Colonel Dan J. Beakey, USA
Senior Research Fellow

National Security Affairs Monograph Series 82-6

1982

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FOREWORD

A major problem, rarely addressed in defense literature, concerns how to support the large-scale overseas deployment of US military forces. The formation of the Rapid Deployment Joint Task Force has added a practical urgency to finding answers to these support questions. This monograph responds with a close look at strategic sealift, a key element of any answers.

Colonel Dan J. Beakey, US Army, examines the US capability to conduct "Logistics Over the Shore" (LOTS) operations. A review of history demonstrates that LOTS operations are not new in military planning, but have undergone significant changes in the last two decades. New technology—for example, the arrival of the container ship in the merchant marine fleet in the 1950s—has challenged LOTS planners to develop successful military adaptations. The author concludes that the US capability to conduct LOTS operations may not be sufficient to meet the demands of current contingency plans. To improve US capability in this area, the author recommends concrete, relatively low-cost measures. The solutions will involve purchasing the right amounts of the right equipment and clarifying Service roles.

This study complements other NDU efforts, such as the recent monograph by Colonel Lewis Sowell on *Base Development and the Rapid Deployment Force: A Window to the Future.* This research reflects the University's continuing commitment to analyze the problems that confront America's defense planners. The National Defense University is pleased to offer these perspectives to those who will ultimately be responsible for planning strategic mobility.

JOHN S. PUSTAY
Lieutenant General, USAF
President, National Defense University

ABOUT THE AUTHOR

Colonel Dan J. Beakey, United States Army, wrote this monograph while serving as a Senior Research Fellow at the National Defense University. He is currently assigned as Deputy Test Director for a Joint Logistics Over the Shore exercise (JLOTS II) involving all services. Before joining the University, he served on the Department of the Army Staff and Office of the Joint Chiefs of Staff (Logistics Directorate). He commanded the 79th Transportation Battalion and was Post Commander, Fort Story, Virginia from 1975 to 1978. Colonel Beakey holds a bachelor's degree from the University of Oklahoma and a master of business administration degree from the College of William and Mary. He is a graduate of the US Command and General Staff College and the Industrial College of the Armed Forces.

EXECUTIVE SUMMARY

Sealift has always been the primary means of transportation to support large scale deployments of US forces overseas. In the past, ships were capable of discharging cargo with internal booms or on-board equipment. This discharge operation could be completed at conventional deepwater piers, or in an emergency, to smaller boats or lighters for further movement to the shore. The military term for this latter operation is known as Logistics Over the Shore or LOTS.

Starting in the 1950s, a major change in the US merchant marine severely limited these proceedings—the container ship arrived. These ships brought speed, efficiency, and fundamental changes to our merchant marine fleet; and with these capabilities significant problems arose for military logisticians who searched for ways to discharge container ships if seaports were damaged or unavailable.

This paper addresses progress made during the past two decades by the Army and the Navy in building a LOTS capability. This progress has been extremely slow and, to date, has produced only a minuscule capability in the active forces of both services. Although we have not been required to conduct an operation dependent on this critical link in our strategic mobility system, contingency plans that address areas in our national interest require a LOTS capability.

This monograph evaluates major components of the Army and Navy LOTS programs. Emphasis is placed on highlighting subelements and equipment that offer real promise toward correcting this serious deficiency in military readiness. Addi-

tionally, a call is made for greater cooperation between the services by buying common equipment. Recommendations regarding fundamental change in service responsibilities for offshore discharge of container ships and a suggested minimum LOTS capability are offered in the final sections of the paper.

Unlike many challenges facing defense planners, the absence of a reliable LOTS capability can be corrected at a reasonably low cost and in a short period of time. The solutions are available, affordable, and need only concerned, strong leadership.

1. PARTNER TO SEALIFT—LOTS

Discharging ships and bringing the cargo across the beach—otherwise known as *Logistics Over the Shore* (LOTS)—is a dumb idea! It is difficult, takes special equipment not found in commercial terminals, and may never be required in the next war; therefore, we should not invest large amounts of money in such a program.

These comments are outrageous. However, if we look at the progress made by the Army and the Navy during the past ten years, it is obvious we are not seriously pursuing a reasonable LOTS capability for the near future.

A primary factor contributes to this delay: we are not sure that LOTS operations will be required in future conflicts. Logistics planning to support deployed forces on a foreign shore always begins with an evaluation of "in-place" or fixed port capacity. These calculations, combined with connecting railway, highway, and inland waterway networks, are the major logistic assessments required to plan military operations. Although the air lines of communication carry high priority shipments and transport of personnel, at least 90 percent of the tonnage required to support deployed forces must be provided by the sea lines of communication. At this point critical questions must be asked.

- Will the ports be intact and available for military requirements?
- Can the ports handle resupply requirements?
- If the ports are damaged, how quickly can they be repaired? In the interim, will we be required to resupply over the shore in order to continue operations?

Of course we cannot know the answers to these questions for every situation nor is it the purpose of this paper to defend or minimize the effectiveness of LOTS operations. Many scenarios do not require LOTS operations. What war, however, ever conforms to scenarios? The following points underscore the fact that the Army and Navy should field a LOTS capability that is needed now by the Commander, Rapid Deployment Joint Task Force (RDJTF):

- Future employment of the RDJTF in many regions of southwest Asia or Africa will require *some* LOTS capability, for port capacities are extremely limited and vulnerable.
- Past military operations during World War II, Korea and Vietnam have required LOTS operations.

Determining finite logistic requirements in any aspect of military planning is difficult. The growing costs of weapons systems, fuel, repair parts, and manpower truly tax our abilities to allocate defense dollars wisely. Past emphasis on the NATO scenario virtually eliminated any requirement for a LOTS operation. By comparing potential wartime logistic requirements against in-place civilian facilities such as ports, highways, and rail/truck assets under the aegis of "host nation support," planners concluded that no requirement existed for LOTS in the European theater. Accordingly, with defense guidance that emphasized the NATO scenario as the template for all service funding, LOTS equipment and force structure needed in other contingencies remained low in funding priorities. However, during the later years of the Carter administration, events in Iran and Afghanistan caused the formation of the Rapid Deployment Force with potential missions both outside the bounds of NATO and in the Persian Gulf. Unfortunately, fixed ports in these regions are limited in both number and capacity.

With the Reagan administration, the goals of protecting our national interests have again shifted to a global viewpoint and have moved away from a singular emphasis on NATO. This broader perspective underscores the necessity to conduct military operations in many regions of the world where host nation facilities are limited or nonexistent. Congress has also called for a LOTS capability. For example, Congressman Robin Beard (R-Tenn.) recently identified the Army's limited capability to conduct LOTS operations as one of eight major shortcomings requiring correction.[1]

It is imperative to develop and provide a LOTS capability for the RDJTF that provides flexibility concerning where and how the Commander conducts military operations. These operations will enjoy a higher degree of success if logistics planners ensure that resupply can continue through the use of conventional ports, over the shore, or a combination of both.

YARDSTICKS FOR SUCCESSFUL LOTS OPERATIONS

Certain characteristics or criteria measure the effectiveness of a reliable LOTS capability. The following factors are essential when developing equipment, unit force structure, and doctrine:

- LOTS operations are characterized by sustained, high-tonnage movements from ship to shore. Each link in the system must be able to maintain the flow of cargo.
- Sustainability and reliability are more important than a surge capability that cannot be maintained.
- LOTS operations are conducted in austere environments. Only limited shore facilities will be available to maintain watercraft and related equipment.
- LOTS equipment must operate in moderately rough seas. Subsystems that operate only in calm seas and ideal weather limit the entire discharge cycle to that lowest common denominator.[2]
- Deployability of equipment required to run a LOTS oper-

ation is critical. Large items requiring lift by scarce special shipping severely weaken our capability.

This paper will review the development and progress of both the Army and the Navy efforts to achieve a responsive LOTS capability. As each item of equipment is discussed, capabilities will be measured against these yardsticks. The services should agree upon a baseline LOTS requirement, expressed in daily container and breakbulk tonnage figures, that will provide a road map for future procurement and development of force structure. By setting this target or goal, we can better measure the many links in both the Army and Navy systems in terms of effectiveness, efficiency, maintainability, and economy. This procedure removes much of the doubt, indecision, and inertia that have delayed fielding a Logistics Over the Shore capability during the past decade.

2. ARMY CAPABILITIES FOR LOTS OPERATIONS

Prior to 1970, the Army's capability to unload deepwater ships was built around the Terminal Service Companies. These companies, sometimes referred to as stevedore units, were large organizations with a unit strength in excess of 300 personnel. They were organized around the task of unloading typical cargo ships, and they used the ships' gear or booms which allowed cargo to be transferred directly to the pier or to small watercraft for movement to shore. These ships, commonly referred to as breakbulk vessels, were the primary means of resupply throughout both world wars, Korea, and much of the Vietnam conflict.

The Terminal Service Companies were equipped and trained to perform discharge operations in either a fixed port with deepwater piers or in a LOTS operation if ports were damaged or unavailable. When required to discharge cargo in a LOTS mission, Army boat and amphibian units were assigned to the major command and control unit, thus providing the ability to bring the cargo across the beach for further handling by the shore teams of the Terminal Service Companies.

The productivity of the Terminal Service Company is relatively low because discharge of breakbulk ships is an extremely labor-intensive effort. Each "swing" of the ship's gear carries only a single pallet or relatively light load of cargo. The productivity of this unit is degraded further in many situations when cargo is discharged on the beach or pier for sorting and consolidation before loading onto trucks or rail cars for further movement. Laborious, detailed documentation is also required

to ensure routing to the right destination.

From just this short description of breakbulk cargo operations, we can appreciate the need to improve the efficiency of such a cumbersome system. The first answer was supplied in the 1950s—consolidate small shipments in a single box or container. Widespread acceptance of the container signaled the beginning of what has been described as the "container revolution" in the transportation industry.

EVOLUTION OF CONTAINERS

The First Military Container—CONEX

The Army was instrumental in starting the container revolution by introducing the Container Express or the CONEX. A small container by today's standards, the CONEX, first introduced in 1950, had dimensions of approximately 8′ x 6′ x 7′. The utility of this steel container quickly became evident when it reduced many of the handling, security, and consolidation problems of moving cargo. Although the CONEX was originally designed to improve the movement of household goods, the Army quickly expanded use of the container to many commodities. The original purchase of 167 containers grew to an inventory of over 100,000 in 1964. The CONEX was so versatile it was sometimes found in forward units in Vietnam as sand-bagged command posts, bunkers, and even chapels. Additionally, the CONEX provided a storage capability that at the height of the Vietnam War (1966–69) represented six million square feet of covered storage space. This was over 35 percent of the total covered storage space available in the country in 1969.[1]

The MILVAN

The Army began buying a follow-on military container, the MILVAN, in the early 1970s. The original procurement provid-

ed a total of 6,700 containers, including 4,500 MILVANs equipped with removable restraint bars. These devices permit securing of ammunition pallets in order to meet US Coast Guard safety criteria. The MILVAN is an extremely durable container (8′ x 8′ x 20′) capable of handling up to 20 tons of ammunition or general cargo. As of October 1981, the Army's inventory of MILVANs included 4,200 ammunition restraint and 2,103 general cargo containers.

The Intermodal Containers

During the 1960s, the transportation industry rapidly expanded commercial use of containers. It became apparent that larger containers—20′, 35′, or even 40′, adaptable to truck and rail carriers—paid huge dividends in economy and flexibility. Containers permitted intermodal shipment—from warehouse, truck, rail, over-ocean ship—to final destination as one integral unit. Instead of loading a ship with literally thousands of individual boxes, pallets, or drums, containers created single units that "juiced up" the entire transportation system. These systems reduced cargo pilferage, simplified paperwork and documentation, and slashed labor costs. Expensive warehousing and consolidation points were avoided. Ships were loaded in hours instead of days.

Containers Bring Problems for the Military

In spite of these benefits, the military planner realized that this great advance in peacetime transportation also introduced massive problems in a wartime environment. How will we discharge these large containers ranging in sizes from 20 to 40 feet if modern fixed ports were not available? Naturally, we will use fixed port facilities if available; however, if these facilities are damaged by enemy action or are not in the required area of operations, we will have to establish our resupply operations over the shore. The potential task of extracting a thousand or more containers from a ship 2 to 10 miles offshore and then bringing them across the beach was indeed a

job too big for the Army's conventional Terminal Service Company. No longer could soldier stevedores climb aboard the ship, rig the lifting booms, and begin discharging cargo. Although the original container ships were equipped with onboard cranes (self-sustaining), owners soon realized that it was more economical to use shoreside cranes. As a result, few container ships had booms or built-in cranes (nonself-sustaining) that would allow discharge of these containers offshore. A solution had to be found.

Military planners wrestled with this problem for several years. Well-meaning innovators thought of many schemes to meet the challenge. Ideas actually tested even included heavy-lift helicopters and lighter-than-air balloons used in logging operations. These tests proved entertaining and novel but were not very effective in moving a large number of containers from ship to shore. Extreme sensitivity to weather and sea conditions was the main disadvantage which led to the ultimate rejection of these schemes as practical and economical solutions. Helicopters can certainly be used for high priority lifts when the tactical situation demands speed, but during typical LOTS operations where sustained, high tonnage movement of cargo is required, limited helicopter resources would not be available to meet these massive requirements.

THE TEMPORARY CONTAINER DISCHARGE FACILITY

The Army finally turned to a simple and less exotic solution: a mounted 300-ton capacity crane on a floating Delong pier barge that could be moored next to the container ship and lift containers from the ship and transfer them to boats or amphibians. This system was tested both in 1972 and later in 1977 during the Joint Logistics Over the Shore (JLOTS) test at Fort Story, Virginia.[2] This barge-based Temporary Container Discharge Facility (TCDF) proved to be a feasible and workable solution to a problem that had plagued planners for years. Figure 2–1 shows this type of TCDF.

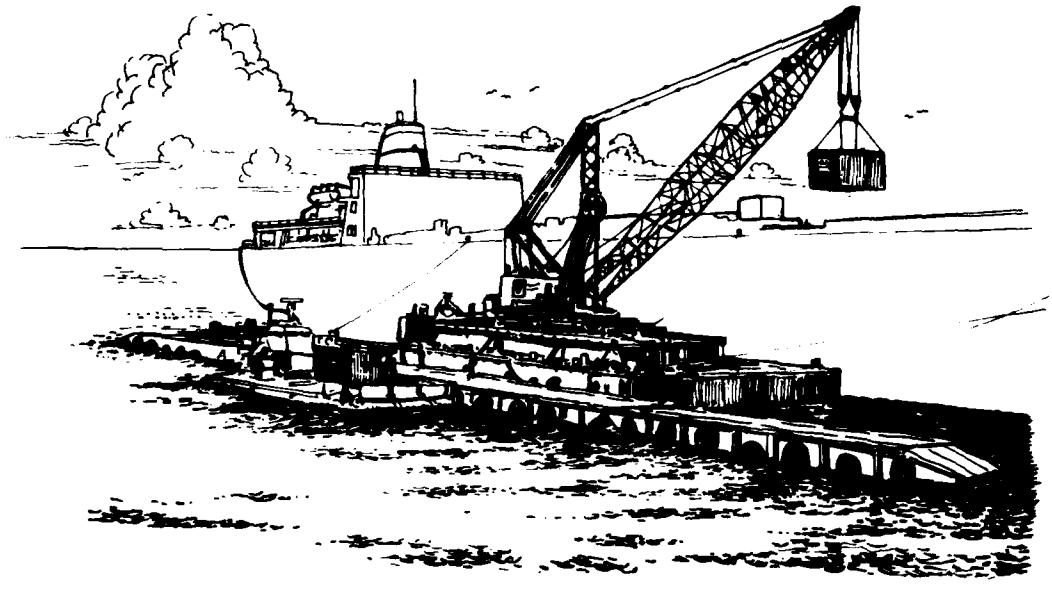

Figure 2–1: Temporary Container Discharge Facility (TCDF)

Although the barge TCDF is currently the only "game in town" for the Army, it does have serious and limiting shortfalls as follows:

- Sensitivity to weather and sea conditions. (It is feasible only in calm sea conditions known as sea state 1.)
- Dependency of the system on the skill of the crane operator. (It takes considerable practice to develop sustained speed in crane operations.)
- Deployment of the barges requires specialized shipping. (The Seabee ship is the only vessel capable of deploying the TCDF and there are only three Seabee ships in the US Fleet.)

THE SHORE SIDE

Turning to the shore capacity of the Container Company, one encounters less demanding tasks and more workable solutions. The Container Handling Company is equipped with a variety of vehicles and equipment adapted from commercial

forklifts, cranes, and similar equipment. Although these vehicles are designed to operate on the beach, it may be necessary to stabilize soft sand with portable matting in order to operate them.

On the shore side, the Army plans to use a 140-ton capacity crane positioned on an A-type Delong pier to unload lighters. This pier is similar to the smaller B-type barge used as a platform for the TCDF, though it is considerably larger (300′ x 80′ rather than 150′ x 60′). Both Delong piers are floating barges that become piers by pneumatically jacking the self-contained legs into the sand. The larger pier is the Army's preferred platform for the discharge of lighters at the beach. The pier is big enough to accommodate semitrailer trucks or yard tractors organic to the Container Company and permits direct clearance of containers from the beach area.

The major drawback to the Delong pier is the lengthy deployment time. For example, towing the pier at a rate of 5 knots per hour from the East Coast of the United States to the Persian Gulf region would require over 60 days, assuming ideal weather conditions. Therefore, prepositioning these piers in forward locations is the only reasonable alternative; however, the smaller B-type Delong could be used until the larger pier arrives. A second major limitation in using these piers involves the beach gradient. For example, in very shallow water (typical in southwest Asia), it would be impossible to discharge small Army or Navy lighters because they require a depth of 6 feet when loaded.

PRODUCTIVITY OF CONTAINERS VERSUS BREAKBULK

Up to this point, we have traced the evolution of cargo operations from conventional breakbulk operations to a more efficient system which is built around the container. However, it is important to make a direct comparison of the capabilities of the breakbulk Terminal Service Company and the Container Handling Company. The following table displays the

capabilities which strongly support the Army's continued emphasis on containerization:

TABLE 2-1: Productivity Comparison—Container versus Breakbulk[3]

Cargo	Container Company	Breakbulk Company
Personnel	285	325
Breakbulk Cargo Discharged	—	1,000 Short Tons
Containers Discharged*	265	—
Total Short Tons	4,639**	1,000

*Assume 75% of Containers loaded with ammunition, 19 tons per box.
25% of Containers loaded with general cargo, 13 tons per box.
All statistics based on sustained daily operations.
**Over 4 times more productive.

To achieve greater flexibility in unloading either breakbulk cargo or containers, the Army has planned an equipment augmentation package for each container handling company. This package allows the container company to deploy to an area when cargo operations are totally breakbulk oriented. Later, the same unit can shift to their container handling equipment and discharge containers. Although this scheme is appealing on paper, the peacetime task of both maintaining two very large sets of equipment and training the troops to operate many different types of trucks, forklifts, and cranes is a "mission impossible" for most company commanders.

THE ARMY'S WATERCRAFT FLEET

Although the Army initially builds a LOTS task force around the Terminal Service Companies—breakbulk and container types—an equally important part of that task force includes watercraft which bring the cargo from deepwater ships to the shoreline. These craft include boats, amphibians, and

other vessels used for a variety of functions in harbor and coastal waters.

As of September 1980, the Army owned 626 watercraft ranging from a ferry boat used as a recreational craft at West Point, to a new air cushion amphibian known as LACV 30, which is capable of speeds over 40 knots per hour.[4]

ROLES AND MISSIONS

The Army watercraft fleet has three predominant missions:[5]

- Logistics Over the Shore (LOTS) operations.
- Support to and augmentation of established ports.
- Coastal, harbor, and inland waterway support.

The latter two missions have historical precedent and are certainly *possible* requirements in support of a deployed force in many of the lesser developed countries. Commercial assets, however, are more likely to accomplish these missions. Accordingly, when planners are developing force structure and defending significant expenditures of dollars, the latter missions emerge as somewhat "soft" requirements. It becomes difficult to state with conviction that military watercraft must be available to augment established ports and provide coastal, harbor, and inland waterway support. On the other hand, a LOTS mission differs significantly from a peacetime or purely commercial operation. When analyzing the three major roles for the fleet, it is prudent to concentrate resources on watercraft that contribute directly to LOTS operations. Deployability, high capacity, and capability to operate in unrestricted beach gradients and weather conditions are the hallmarks for this equipment.

The present family of boats includes landing craft over 20 years old. With few exceptions, this fleet is characterized as a mix of makes and models, technologically dated, and essentially "forgotten" by the Army when budgets are developed at

the Pentagon. High level interest in the Army fleet was gained only when planners recently expanded their contingency planning beyond the NATO scenario and adopted a global perspective to include the awesome mobility requirements to transport and sustain a force in southwest Asia. They realized that the Army's LOTS capability was extremely limited and that many of the watercraft had become candidates for a museum or salvage yard. Consequently, in 1980, the Army Materiel Development and Readiness Command (DARCOM) and the Training and Doctrine Command (TRADOC) conducted a comprehensive review of the fleet which resulted in the Army Watercraft Requirements Master Plan (AWRMP). The plan described the current fleet as follows:

- Majority of craft reach the end of useful life by 1984.
- Seventy-five percent of craft are 25 to 35 years old.
- The LACV–30 and 1646 class LCU are the only modern designs.
- Fleet is breakbulk oriented and relies on special shipping for deployment.
- Logistical support is marginal and overseas deployment requires 30 to 120 days for majority of fleet.

In spite of this pessimistic appraisal, selected Army watercraft are absolutely necessary for LOTS operations, and by using certain types of units and equipment from the current fleet and through careful selection of new equipment, a reasonable capability can be obtained at affordable costs.

The Landing Craft Utility, LCU

The primary landing craft that offers the most capacity and all-around cargo utility is the LCU. This craft can transport troops, vehicles, general cargo, and four 20-foot containers. Two models comprise the LCU fleet: the 1466 class, which is an aging model (1954) now requiring a product improvement program; and the 1646 class, a newer model (1978) with considerable improvements in performance and maintainability.

But since a very limited number of heavy-lift ships in the US flag fleet can transport the LCU, these boats are difficult to deploy. For example, only two heavy-lift ships in the Military Sealift Command's fleet (Transcolorado and Transcolumbia) can lift LCUs and both are 35 years old. Thus, limited deployability is a major drawback.

The Landing Craft Mechanized, LCM–8

The LCM–8, also designed for the transport of troops, general cargo, and vehicles, is a smaller version of the LCU. Although not originally designed for containers, the LCM–8 is fully capable of LOTS operations and can carry two 20-foot containers. Procurement of the current fleet of 137 boats occurred from 1954 to 1972. These boats can be carried on the deck of many commercial ships, reducing the problem of deployability encountered with larger lighters.

The Amphibians

The Army has a family of amphibians—watercraft fully capable of both water and land operations. These craft are highly versatile because shallow beach gradients that limit the operation of other landing craft have no effect on the amphibian. However, the number of amphibians is declining. The inventory includes the Lighter Amphibian Resupply Cargo V (LARC V) and a larger version, the LARC XV. These were designed in the 1960s to transport both palletized cargo and the CONEX, thus making them obsolete in today's container environment. And, because of cargo limitations and extensive problems in reliability and maintenance, both craft are being phased out of the inventory.

The oldest amphibian still in active and reserve units is the mammoth LARC LX, built in the 1960s. This craft was designed to carry tanks or other heavy equipment ashore. Although not designed for containers, this amphibian can easily transport one 40-foot container or two 20-foot containers with

no load limitations. The LARC LX is scheduled to remain in the inventory until a replacement heavy lift amphibian is developed and procured in the mid-to-late 1980s. The LARC LX is shown in Figure 2–2.

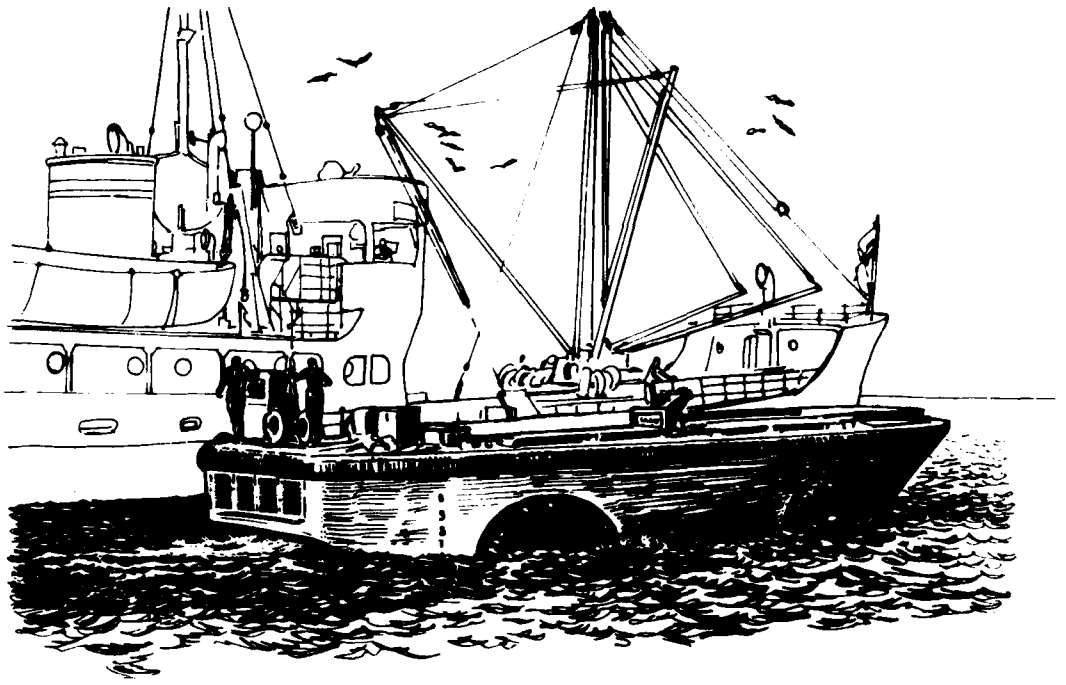

Figure 2–2: Lighter Amphibian Resupply Cargo LX (LARC LX)

The Lighter Air Cushion Vehicle–30 ton (LACV–30)

The latest member of the Army's watercraft fleet, the LACV–30, is an air cushion amphibian that has high speed capability over water, beaches, and land. Although the Government Accounting Office has criticized the Army for not fully testing this military adaptation of a commercial item (Bell Voyageur), the Army is buying and establishing a company-sized unit (12 craft) at Fort Story, Virginia.[6] Figure 2–3 shows the LACV–30.

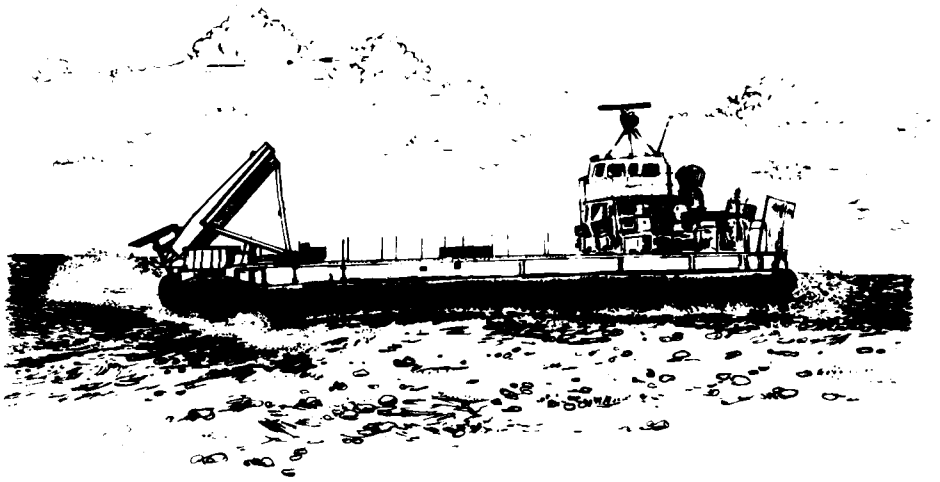

Figure 2-3: Lighter Air Cushion Vehicle-30 ton (LACV-30)

The LACV-30 has been a controversial development item. This controversy centers on the following key strengths and weaknesses of the craft. The strengths are

- Extremely fast—over 40 miles per hour.
- Lightweight, easy to deploy, air transportable when disassembled.
- Operates in rough seas and over ice, snow, and marshes.
- Operates on 70 percent of the world's beaches—not limited by sandbars or beach gradients.

Against these strengths we must consider the following weaknesses:

- Limited payload—only one container unless cargo is light.
- Expensive—$5.2 million per craft in 1980.
- Difficult to maneuver on land.
- Sophisticated design requires advanced technical skills to maintain. Ratio of maintenance to operating hours is high.
- High fuel consumption.

The Army has determined that the potential capability of this high-speed amphibian is worth the risks and costs associated with it. The current program projects building two companies of the LACV–30 with a total of 12 craft in each unit.

Funding Army Watercraft

The Army Watercraft Requirements Master Plan (AWRMP) is a positive improvement in determining the Army's total requirements. This ambitious modernization program, however, may prove too costly. The grand total for this program, which meets all perceived contingencies and training requirements through 1990, exceeds $1.3 billion. The plan failed to gain essential funding support in the 1982 budget, and in all likelihood, it faces similar treatment in subsequent budgets. This expensive program must be reduced to match more realistic requirements. Watercraft missions tied directly to LOTS missions must be more clearly identified and then separated from "soft" requirements which can be satisfied with civilian or commercial assets. Although this dependence on civilian resources is not desirable from a military planning standpoint, it may offer the only hope of getting funding support at an affordable level—far below the original $1.3 billion price tag.

Military planners should also consider the growing fleet of workboats used by US oil companies as a civilian resource with military application. These vessels are self-deployable and capable of lifting a variety of equipment as well as 10 to 20 containers. The fleet could be a cheap substitute for many of the unfunded requirements now in the Watercraft Master Plan. A contingency program to "call up" selected craft would fill some of our current shortfalls in achieving a LOTS capability. This approach is similar to the "Host Nation Support" concept which uses civilian resources to meet military requirements. These workboats would augment the fleet of pure military watercraft until deepwater piers are repaired. The services should investigate the size and capacity of this fleet.

SUMMARY OF ARMY CAPABILITIES

Army LOTS capabilities depend on old and new equipment, including these key support elements:

- Container Handling Companies. Over 4,000 tons of discharge capability daily. Critically dependent on the barge TCDF or other means for deepwater container discharge. With augmentation, can also handle breakbulk ships.
- Breakbulk Terminal Service Companies. Labor intensive. Capable of 1,000 tons breakbulk discharge daily. Essential for handling supplies and equipment not suitable for containers.
- Landing Craft Utility Companies. Container-capable as well as general cargo. Beach gradients in many parts of the world restrict operations. Deployment limited to only a few ships in the US fleet.
- LCM–8 Companies. Limited container capacity plus aging fleet, but relatively easy to deploy.
- LACV–30 Companies. Air cushion permits employment across most beaches. Deployability and high speed are greatest assets. Limited payload. Will be difficult to maintain in a beach environment.
- LARC LX Detachments. Old, slow, but reliable. High payload. Proven performer, but requires replacement in the future.

The next chapter will review the Navy's program for achieving a LOTS capability during the Assault Follow-on Echelon of a Navy-Marine Corps amphibious operation. This phase of an amphibious landing is essentially the LOTS mission for the Navy and equates to the Army's program described in this chapter.

3. NAVY CAPABILITIES FOR LOTS OPERATIONS

The Navy and Marines have a mutually supporting program for LOTS operations under the title Amphibious Logistics Support Ashore (ALSA). This system is divided into the Field Logistics System (FLS) under USMC leadership and the Amphibious Logistics System (ALS) under Navy supervision. The supporting subsystems are shown in Figure 3–1.

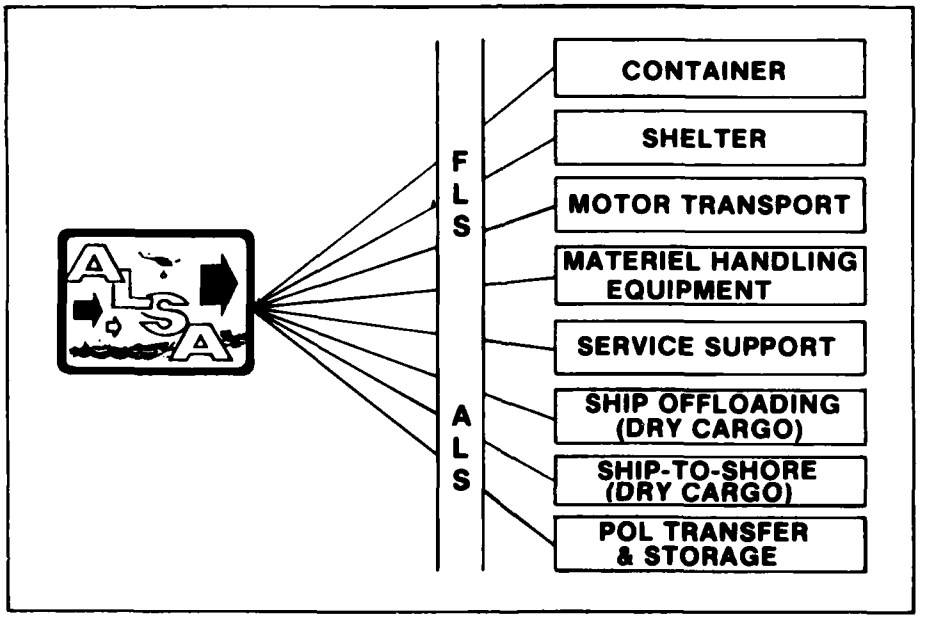

Figure 3–1: The Amphibious Logistics Support Ashore (ALSA) and Its Supporting Subsystems

THE MARINE CORPS FIELD LOGISTICS SYSTEM

The Marine Corps Field Logistics System is based upon maximum use of containers. The system is based on the assumption that commercial container ships will be the major means of resupply to Marine forces after assault landings. In order to take advantage of containerization and retain deployability on amphibious ships incapable of accommodating below decks any cargo higher than 8 feet, the USMC has developed a family of containers. This approach meets ascending packaging requirements from the smallest insert with a cargo capacity of 120 pounds through the Quadruple Container (QUADCON) with a capacity of 7,435 pounds. Each container is designed to be compatible with standard commercial containers as shown in Figure 3–2. The smaller containers can be lifted by helicopter as well as the rough terrain forklifts used by Marine units.

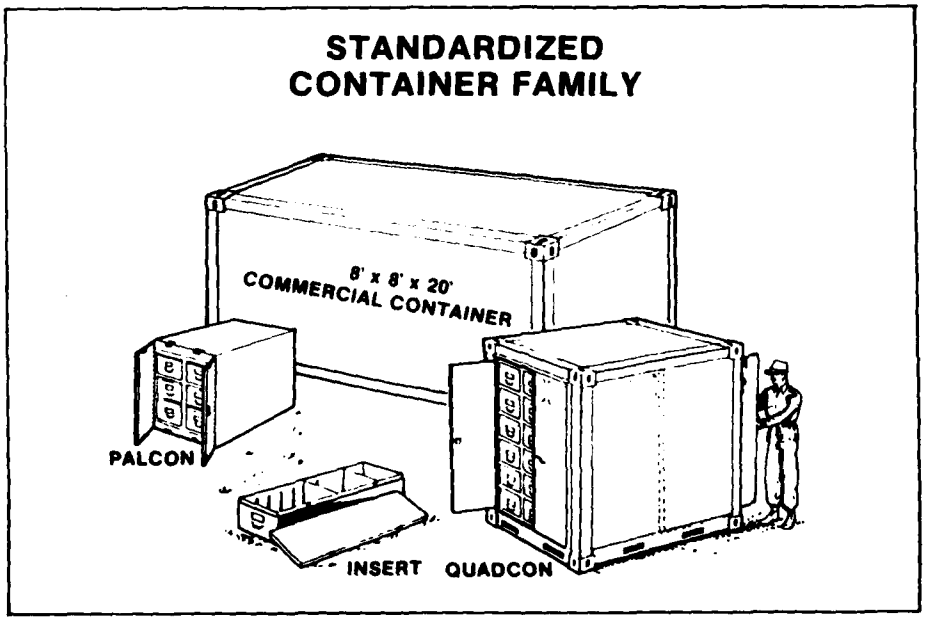

Figure 3–2: Standardized Container Family

The Marine Corps envisages that the assault elements will carry only organizational weapons, essential equipment, and basic loads of ammunition packaged in the smallest container, the insert. Following the assault elements, the initial buildup of supplies will be packaged in the PALCON. After forces are built up and the beachhead is expanded, the QUADCON is used. Approximately ten days later, the larger commercial 20-foot containers will start to arrive and will provide the primary means for resupply.

The remaining subsystems of the FLS shown in Figure 3–1 are Shelter, Motor Transport, and Service Support. Although these programs do not directly relate to LOTS operations and are not discussed in this paper, each subsystem is designed to move supplies in standard 20 foot commercial containers. Thus, transportability features are engineered into equipment insuring compatibility with commercial container ships without sacrificing tactical mobility. For example, the Marine Corps shelter system is modular in design allowing shelters to be used as small, single entities (8′ x 20′), or they are joined together to provide large area and support facilities (hospitals, maintenance shops, and administration buildings).

THE AMPHIBIOUS LOGISTICS SYSTEM

The Navy's Amphibious Logistics System has two major components, the Container Off-loading and Transfer System (COTS) and the Offshore Bulk Fuel Systems (OBFS). Although the discharge of bulk fuels is an important element of LOTS operations, it is outside the scope of this paper.

The COTS program is the Navy's research and development effort that responds to the challenge of using container ships in LOTS operations. This program addresses not only container ships, but barge ships and roll-on/roll-off ships, all of which normally require varying degrees of fixed port facilities.

Discharge of the Ship

The first link in the COTS system is the task of unloading containers from the ship to lighterage. The Navy first developed the idea of placing cranes on nonself-sustaining container ships in 1972. The Crane on Deck concept (COD) shown in Figure 3–3 responds to a high threat environment where each container ship must have an unloading capability rather than reliance on a few special ships outfitted with cranes that will discharge all container ships.

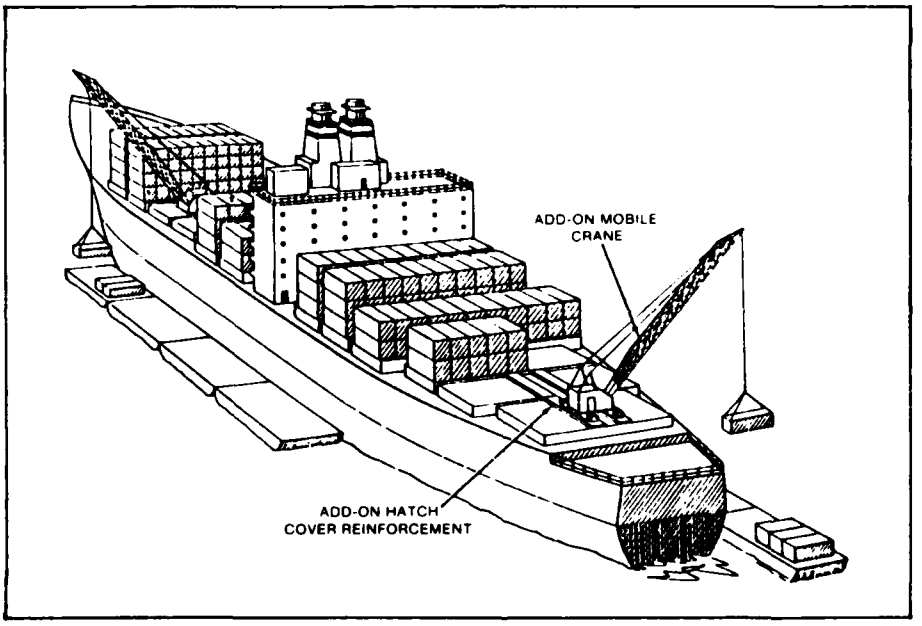

Figure 3–3: Crane on Deck (COD)

The technique of using mobile cranes on the deck of a container ship was tested during the Joint LOTS exercise in 1977. This operation is relatively simple and requires only bridging "tracks" for the crane (150- to 200-ton capacity unit) to rest on as a platform during discharge. Subsequent "leapfrogging" of these units distributes the weight of the crane, allowing it to move from hatch-to-hatch during discharge operations. The Navy has estimated that these portable bridging

units would fit about 80 percent of the more than 100 US flag container ships that are nonself-sustaining.[1] Limited alterations to these ships are required to accommodate the cranes. The Navy estimates that 10 to 15 percent of the ship's cargo space would be lost by the 2 to 4 cranes and associated equipment required for each ship. Based upon tests, a simulation model predicts a crane cycle time of about 6.7 minutes or about 179 containers per 20-hour working day.[2] This figure compares to a cycle time of the Army's barge TCDF of about 5.8 minutes or 207 containers per 20-hour day.[3] Both rates assume ideal weather conditions and calm seas (sea state 1).

Although the COD discharge system is a workable means to discharge container ships, the high cost of buying such a large number of cranes to provide this capability to each ship prompted the Navy in October 1977 to seek another solution—the ship Temporary Container Discharge Facility (TCDF). The TCDF proposed that cranes with a reach of 150 feet and a lift capacity of 35 tons (capable of lifting 40-foot containers) be placed on the decks of existing merchant hulls—preferably, but not necessarily, tankers. This concept, shown in Figure 3–4, was originally proposed as early as 1966 but was not studied by Navy and Army engineering agencies in detail until the 1969–74 time frame.

The ship TCDF offers several advantages over the COD system and the Army's barge TCDF. First, by using a deepwater ship as a crane platform, discharge operations can be sustained under sea state 2 conditions and also sea state 3 with only minor degradation. Secondly, the ship TCDF is self-deployable as opposed to the problems encountered with the barge TCDF. Obviously, total crane requirements are drastically reduced when compared to the COD system. Additionally, when the ship TCDF is deployed, it can carry other large items of equipment associated with LOTS operations such as lighterage and cranes. All these factors are critically important because the number of US flag fleet ships capable of lifting large components of the total LOTS package is extremely limited.

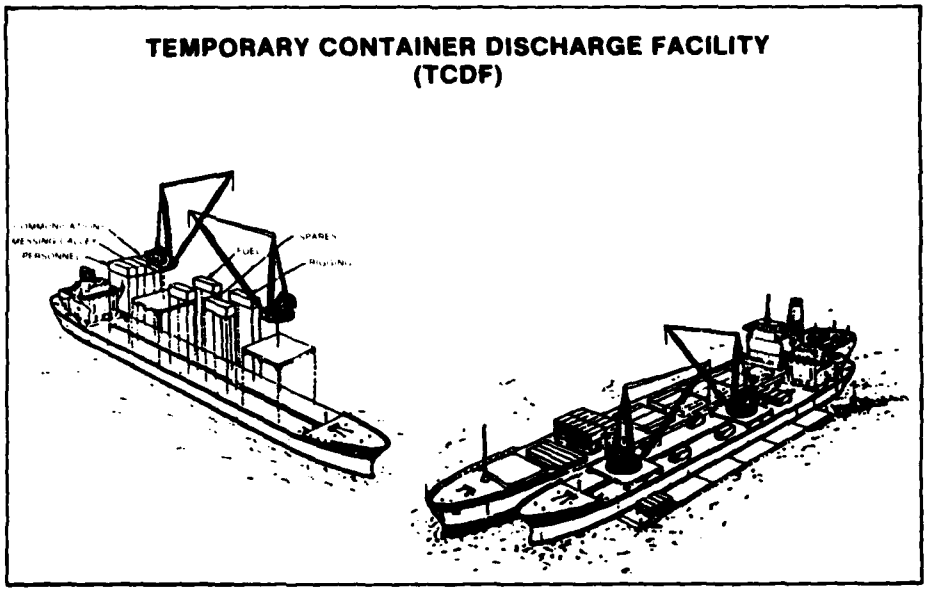

Figure 3–4: Temporary Container Discharge Facility (TCDF)

In February 1982, the Navy refined the ship TCDF program in a somewhat different direction. Instead of storing the cranes in port and installing them on tanker hulls when needed, a decision was made to identify specific ships for this mission. The cranes will be installed in advance and a new ship will emerge—the Auxiliary Crane Ship (TACS). The crane technology and experience gained earlier with the ship TCDF will be applied to the new crane ships; however, by joining ship and cranes together in advance of a contingency, response time is significantly improved. The Navy plans to rely on merchant mariners for manning these ships and the onboard cranes.

The Army has requested that the Navy program include an Army requirement for five crane ships. This request brings the overall program to a total of 11 ships. Questions involving funding and manning for the Army crane ships are being de-

bated between the services. An obvious solution is for the Navy to be assigned total responsibility for discharging container ships for either service in any Over the Shore operation. This solution will resolve funding stalemates and more importantly, will clarify doctrine that is now not clear. This decision might also reduce the total number of crane ships.

Ship-to-Shore Phase

The Navy retains a number of lighters such as the LCU, LCM–8, and LCM–6 which are essentially the same age and in the same condition as the Army's fleet. The Navy, however, has developed new powered barge ferries that are efficient and are relatively low-cost. This system is designed to move containers from the deepwater ships to the beach during the Assault Follow-on Echelon (AFOE) phase of Navy-Marine Corps amphibious operations. This group of lighters consists of pontoons joined together to form causeway sections approximately 21′ x 90′. Some units will be powered and will be capable of pushing one to three nonpowered barges with the same dimensions. Each unit has a cargo capacity of 60 to 100 tons, equivalent to three or four 20-foot containers. The powered sections have twin population modules with each power unit housing a diesel engine, marine gear, propulsion pump, and a rotatable waterjet nozzle. The powered sections capitalize on a reliable power plant (same as the LCM–8) that is easy to maintain. The waterjet thrust eliminates the propeller, allowing full power operation in the shallow, but treacherous surf zone. Routine maintenance and minor repairs can be done ashore without drydocking the craft.

The transportability of these pontoon causeways is a significant advantage. Both the powered and nonpowered causeway sections can be side loaded on the LST (4 per ship) and thus save valuable wet-well shipping capability for larger lighters such as the LCUs and LARC LXs. Figure 3–5 shows the causeway sections in all modes including how they can be

side-carried on an LST. They are easily moved on several types of commercial ships.

Shore Discharge

The Navy has developed an Elevated Causeway System (ELCAS) to transfer cargo from lighters to trucks on the beach. This facility resulted from joining standard causeway sections (21' x 90') and extending the entire platform past the surfline in order to provide a stable pier for the discharge of lighters. Configured with piles, pilewells, and hydraulic lifting devices, the ELCAS can be elevated or erected in 5- to 7-foot surf conditions in 65 to 75 hours. Other major components to the ELCAS include a 30- to 50-ton mobile crane required for erection of the causeway and a 150-ton mobile crane used for

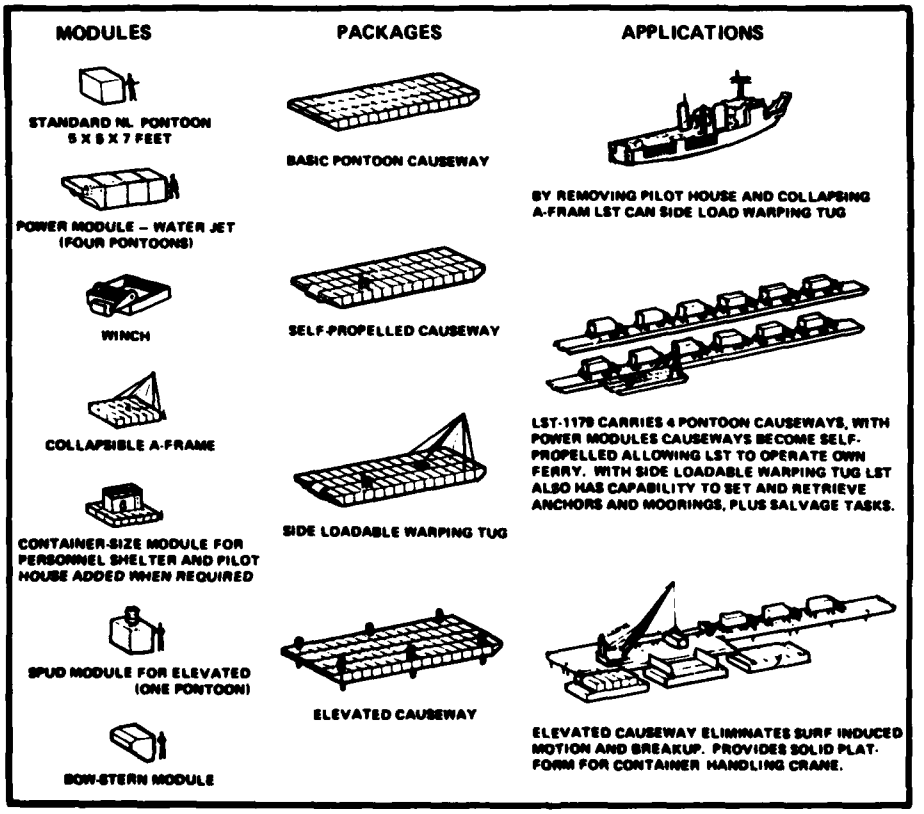

Figure 3–5: Causeway System

transferring containers from lighters to truck. It can handle any military lighter as well as the commercial LASH or Seabee-type forges. Another innovative feature is an air bearing turntable that allows trucks to be driven onto the causeway, turned around, and quickly cleared from the pier with no need for time-consuming backing operations.

Figure 3–6 shows the elevated causeway in operation. A significant feature of this discharge facility is that a major part of the components—the causeway sections—can be sideloaded on LSTs (as shown in Figure 3–5). Any number of merchant ships (breakbulk cargo or barge carriers) can easily lift components of the elevated causeway. For example, approximately 75 causeway sections can be carried by a single LASH ship. Once again, deployability is a big asset.

A related capability well underway is the development of a 120-foot, 60-ton-capacity ramp designed to permit offshore

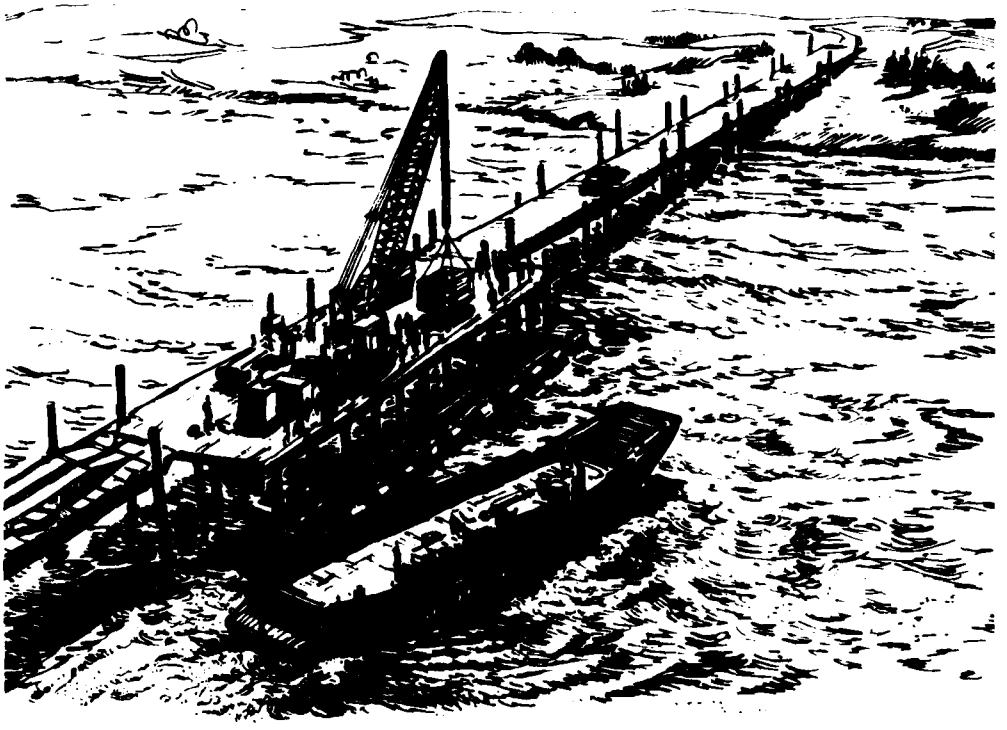

Figure 3–6: Elevated Causeway System

discharge of roll-on/roll-off (RO/RO) ships. This program is designed to use the US merchant fleet of RO/RO ships that are highly efficient in transporting wheeled and tracked vehicles. Like container ships, however, the RO/RO vessel is designed to operate from fixed ports that allow rapid discharge of the ship by driving the vehicles down a ramp to the pier. Consequently, in order to plan for the LOTS contingency, we must develop a technique to discharge these high capacity ships either in the stream or offshore. The answer to this problem is employment of the pontoon causeway sections. These units provide a platform as well as lighterage and are married to the ship with a ramp that connects with the ship's side or stern port. The vehicles can then be driven onto the causeway sections for further movement to the beach. This system is shown in Figure 3–7.

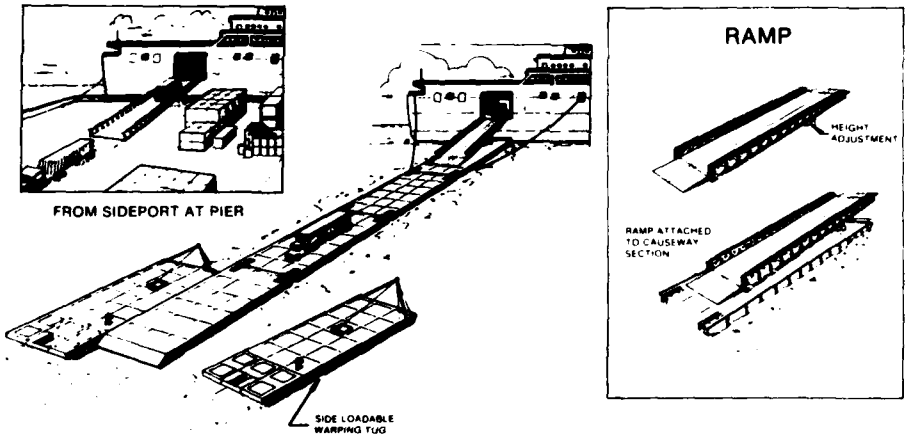

Figure 3–7: Ship Offloading Subsystem Roll-On/Roll-Off (RO/RO) Low Seastate Ramp

THE MARINE CORPS LIGHTWEIGHT AMPHIBIOUS CONTAINER HANDLER

The Marine Corps has developed a versatile and inexpensive piece of equipment designed to transfer containers from

landing craft to trucks. This device is known as the Lightweight Amphibious Container Handler (LACH). It transfers containers from the boats by straddling the container and lifting it from the deck of the lighter. The LACH, propelled by its prime mover (a medium-size bulldozer), can be employed in a 5-foot surf and can handle 20-foot containers with weights up to 25 tons. Low cost and simplicity of operation characterize the LACH. It is the only equipment owned by the services that can lift containers from landing craft in the surf zone.

NAVY CARGO HANDLING UNITS

The Navy's capability to provide the manpower to operate these subsystems of a LOTS operation is limited and critically dependent on an ambitious augmentation plan. The mission of the US Navy Cargo Handling and Port Group (NAVCHAPGRU) is to load and unload Navy and Marine Corps cargo carried by commercial breakbulk or container ships. The NAVCHAPGRU is under Commander-in-Chief, US Atlantic Fleet, and is currently located at Cheatham Annex near Williamsburg, Virginia. This unit has a wide range of specified terminal missions involving cargo handling, terminal facilities, and stevedore functions.[4] These missions include personnel qualified to handle cargo in operations involving the following equipment:

- Elevated Causeway.
- Powered Causeway Ferries and other landing craft/barges. Temporary Container Discharge Facility.
- Hatch gangs on conventional breakbulk ships.

Capabilities of NAVCHAPGRU

Current peacetime manning for this unit is austere—total authorized level for officers and enlisted personnel is 132. Under a graduated scheme, this force is designed to grow to a total of 1,500 personnel. At the base level, the unit provides stevedore teams capable of operating 8 hatches of a break-

bulk ship or 2 container ships using TCDFs (3 to 4 cranes). Under maximum augmentation, the NAVCHAPGRU will be able to operate 16 additional breakbulk hatches or 4 additional container ships and 2 elevated causeways.

Limitations of the NAVCHAPGRU

The limited manning level of this unit is possibly workable under today's conditions when the group is oriented to breakbulk operations. However, as new equipment such as the elevated causeway and the powered causeway sections are delivered to the Navy, this cadre approach may not be effective. Significant training and maintenance requirements will mandate either increased peacetime manning or an aggressive approach in training reserve units. Without this marriage of trained people and new equipment, equipment response time to the RDJTF will be slow.

FUNDING THE NAVY PROGRAM

The cost for fielding the Amphibious Logistics System (ALS) is high. The total estimated cost for the equipment described above totals about $500 million. Although this figure is considerably lower than the $1.3 billion price tag of the Army's Watercraft Program, the Navy has been slow to commit funds to this program. For example, the latest funding profile for the program shows only $33 million in procurement for 1982 and 1983. This leaves about 93 percent of the program in FY 84–87 which could again fall victim to further delays.

SUMMARY OF NAVY CAPABILITIES

In summary, the Navy's LOTS program is a forward looking effort that with adequate funding will develop into a significant capability. Key elements of this system which can provide a great boost to the flexibility of the RDJTF include

- Auxiliary Crane Ship (TACS). Only crane system that is

effective is sea state 2 or 3. Self-deployable and a critical link in any LOTS system.

- Causeway Ferries. Low cost and easy to deploy. Powered and non-powered modes add to flexibility. Simple to operate and maintain. Slow (7 knots per hour) but productive.
- Elevated Causeway System. Easy to deploy and quickly installed. Relatively cheap and can be erected in rough surf.
- USMC Field Logistics System. A rationale concept that "marries" the commercial container ship with deployed forces. Accepts the *container* as the essential core to logistics distribution without sacrificing tactical mobility.
- Roll-on/Roll-off Discharge System. Vitally needed in order to capitalize on ships designed for transporting vehicles. When operational tests are successfully completed, Navy should expedite procurement.

The next chapter of this study will address the issue of defining a LOTS requirement. This approach is a means to combine the best elements of the Army and Navy programs in a package that is responsive to current and future contingency operations. Additionally, a typical joint task force is presented along with a summary of cost considerations.

4. DEFINING REQUIREMENTS—MATCHING CAPABILITIES

Previous chapters of this paper focused on Army and Navy efforts to build a Logistics Over the Shore capability. Progress has been hindered by a lack of *requirements* which drive research, development, and production programs. In most regions of the world where the US would likely deploy forces, some fixed ports exist. Military planners plan for these facilities, and hope, despite the vulnerability of container and RO/RO piers, that the more demanding LOTS operations will never be required. Their way of thinking becomes even more tempting when logistics systems compete with exotic weapons systems for budget dollars.

DEFINING THE REQUIREMENT

The Services, JCS, and DOD need to agree on realistic capabilities that will provide the Rapid Deployment Joint Task Force with the flexibility to conduct LOTS operations, if required. Rather than argue over countless scenarios with many assumptions and variables, we should build a LOTS capability that is effective, deployable, and affordable. This capability should be available to the Commander, RDJTF on a near term basis, and should not be tied to a single, narrow contingency plan. A LOTS capability is only one of many military operations—perhaps comparable to airborne or air mobile options—that can provide flexibility and surprise to an overall campaign.

I will demonstrate the capability of selected equipment previously discussed by presenting a hypothetical resupply re-

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quirement. Although a number of classified simulation models are available and useful for real world planning, this notional requirement is used to demonstrate the relatively low cost of building a near term LOTS capability. The following assumptions are made:

- Troop strength supported is approximately 100,000 ground and 12,000 Air Force personnel.
- Unit equipment for the deployed forces has been delivered.
- Deepwater ports have been damaged and are not available.
- Specific countries and scenarios are omitted.

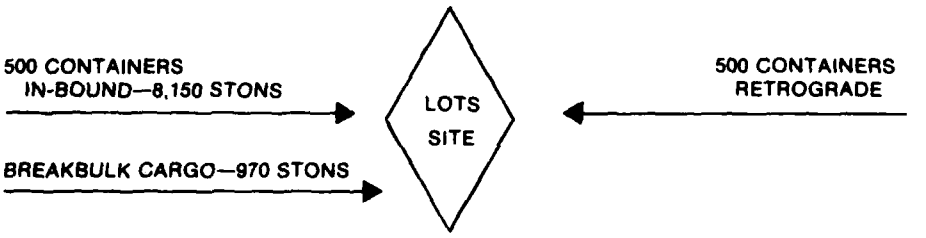
COMPONENTS OF THE REQUIREMENT

Container Requirements

During peak resupply periods, the daily throughput requirement for 20-foot containers under this hypothetical model is about 500 containers—inbound only. At some point, these containers must return through the port in order to sustain the system. Thus, a daily container handling requirement for this 112,000-man force is about 1,000 containers. Although the weight per container varies with the class of supplies,[2] a factor of 16.3 short tons (STONS) per container is a realistic figure for gross planning. Dense commodities such as ammunition projectiles will average up to 20 STONS per container, while lighter weight bulky items will hold down the average container weight.

Breakbulk Requirements

The model assumes a policy of maximum containerization resulting in a daily breakbulk requirement of about 970 STONS per day. These items are primarily odd-sized equipment and vehicles with dimensions that prevent containerization.



TOTAL CONTAINER REQUIREMENT 1,000 PER DAY

TOTAL CONTAINER CARGO REQUIREMENT 9,120 STONS

Figure 4–1: Summary of the Requirement

These requirements establish a realistic planning goal for a LOTS operation in support of about 112,000 personnel. Planners at the Rapid Deployment Force Headquarters have developed more specific and detailed classified requirements for plans responsive to certain scenarios. Even though the requirements summarized in Figure 4–1 are drawn from unclassified sources, they are realistic and valid for broad planning and can be used in an analysis of Army and Navy equipment being procured for LOTS operations.

The required 1,000 containers and 970 STONS of breakbulk per day should not be construed as minimum requirements for contingency operations. Indeed, there may be specified scenarios in regions of the world where a LOTS capability far in excess of these requirements will be essential. Additionally, planners may argue with the high degree of containerization used in these requirements in certain locales. On the other hand, the inherent advantages of containerization, the high productivity of the Army's container handling units, and the large US flag container fleet dictates that our logistics systems and doctrine maximize use of containers.

The military must accept the fact that containerization and container ships represent the primary capabilities of US sealift. Commercial shipping now and in the future is wedded to the container, and the military cannot change this reality. We must build our systems to take advantage of containerization.

BUILDING A CAPABILITY

The next section of this chapter will highlight how the best elements of the Army and the Navy programs can be used in this scenario. A premium is placed on subsystems that are deployable, reliable, and capable of operation in sea conditions with waves up to 5 feet in height.

Temporary Container Discharge Facility

The first link in any LOTS system is to lift the containers from nonself-sustaining container ships to lighterage. Three alternatives respond to this task: barge TCDF (Army), crane on deck (Navy), and ship TCDF or crane ships (Navy).

Barge TCDF. The greatest advantage of this option is that it exists today and has been successfully tested. This system, while not perfect, will do the job. As noted before, however, the B-type Delong barge that provides the platform for this TCDF can be lifted only on the Seabee type ship (three in the US Fleet). Additionally, it is productive only in calm seas, a disadvantage which severely limits its utility and creates considerable risk for the entire discharge system.

Crane on Deck (COD). The COD has been tested and is workable. Although the cranes and associated platforms or weight distribution "tracks" were never procured, the COD can be used as a means to provide self-sustaining capability to commercial container ships. But because of the high cost, the Navy has rejected the placing of cranes on up to 100 container ships. However, in a high attrition environment, this cost

may be acceptable since the COD concept provides a discharge capability to each ship, thus overcoming the vulnerability of other TCDF options.

Ship TCDF or Crane Ship. The Army and Navy agree that the crane ship (referred to as a TCDF or TACS) best meets the difficult task of discharging containers in sea state 2 or 3. The capability to self-deploy and to provide a stable platform for crane operations are key features. A limited test of the ship TCDF in 1980 showed promising results. The pending JLOTS II tests in 1984 will provide an opportunity to evaluate this system over a sustained period of time and to develop firm planning data that will verify the ship TCDF's projected capacity. Using the Navy's preliminary data developed during a technical evaluation test, at sea state 2, the TCDF can handle about 160 containers in each 20-hour day. On that basis, it takes 6 or 7 crane ships to sustain the 1,000 containers per day in our notional requirement. If sea conditions approximate sea state 3, productivity will decline; conversely, calm seas will boost productivity.

Lighterage Requirements

Determining the ideal lighterage mix for 1,000 containers per day is impossible because beach gradients that limit conventional boats have no effect on amphibians. Additionally, the beach gradient determines the safe anchorage for the container ship which, in turn, specifies the distance that lighters must travel from ship to shore and back again.

The Army's Transhydro Craft Study surveyed 12 countries for potential LOTS operations and plotted the 10 fathom line.[1] The study determined that typical container and barge ships envisioned for LOTS operations require an anchor depth of 7.5 to 10 fathoms (45 to 60 feet). Consequently, the potential one-way distance to be traveled by lighters varies from 2 to 10 miles. The data shown in Figure 4–1 suggest that, in many situations, water depth requires a significant distance for ship-to-shore movement.

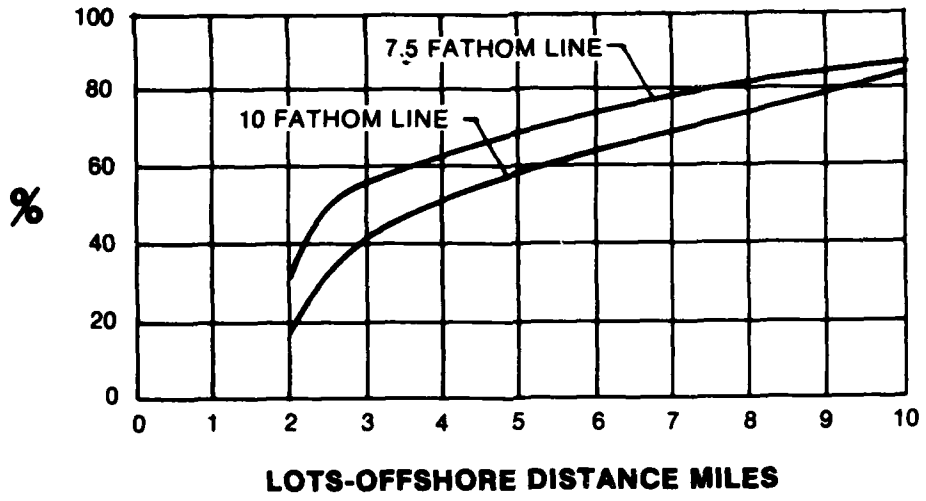


Figure 4–2: Beach Gradient—Transhydro Study

In addition to the distance portion of the equation, speed and lift capacity of each lighter are other critical factors in determining requirements. These characteristics for selected lighters are shown in Table 4–1.

Table 4–1: Lighter Characteristics

Type Lighter	Speed (Knots/Hr.)	Containers Lifted (One-Way)	Remarks
LACV–30 (Army)	35	1.5	1 loaded container or 2 empty containers in a retrograde operation.
LARC LX (Army)	5	2	2 containers per lift. Not constrained by weight.
Powered Causeway Ferry (Navy)	7	6	6 containers per lift. Average 20 STONS per container. Includes one powered section and one unpowered section.

In this notional requirement, assume a shallow beach gradient that requires a leg of about 9 miles for the lighters. This assumption places maximum reliance on the amphibians from the Army and the powered causeway ferry from the Navy. A typical fleet of lighters is shown in Table 4–2.

Table 4–2: Lighter Requirements

Type Unit	Total Number of Lighters	Avail. Factors	Lighters Available	Containers Lifted Per Day	Remarks
(1)LACV–30 Company	12	67%	8	264	1.5 containers per lift.
(2)LARC-LX DET	8	75%	6	56	2 containers per lift.
(2)Powered Causeway Ferry Units*	32	75%	24	749	6 containers per lift.
Total				1,069**	

* Force structure for PCS units not developed at this time. These figures are for planning only and assume that each ferry includes a non-powered barge and a powered causeway section.

** Note: This will accommodate the requirement of 1,000 containers—remainder of capability could be used for breakbulk cargo.

Another aspect of lighterage composition includes fuel consumption. For example, in Table 4–3, fuel consumption by lighter type shows that fuel use per container moved differs significantly among the lighters used. The high speed of the LACV–30 demands huge amounts of fuel and, when compared with the other lighters, becomes a very expensive means of transport. For example, one causeway ferry that costs about $1.2 million delivers almost the same number of containers each day as the $5.2 million LACV–30 and uses only a fraction of the fuel required by the air cushion vehicle.

Table 4–3: Fuel Consumption by Lighter Type

Lighter Type	Water Speed Knots/Hr.	Fuel Use per Hour Opn.(Gal.)	Round Trips per 20-hr. Day	Total Hours per Day Consuming Fuel*	Fuel Consumed per Day (Gal.)	Containers Lifted per Day	Fuel Use per Container (Gal.)
LACV–30	35	240	22	17.9	4,296	33	130
LARC LX	5	38	4.7	19.2	730	9.4	78
Ferry	7	27	5.2	18.5	500	31.2	16

*This includes hours underway plus 75% of the hours at ship, shore, and waiting times.

Shoreside Facilities. On the shore, discharge of the amphibians is relatively easy if the beach surface has been improved and will support wheeled vehicles. The greatest asset of amphibians is their ease of movement across the surfline which is maximized by using conventional cranes to discharge cargo directly to wheeled vehicles. Cranes capable of this task are authorized in the Container Handling Company or can be locally attained in many regions of the world.

Navy Elevated Causeway (ELCAS). Discharge of the powered causeway ferry relies on the Elevated Causeway Pier or the USMC LACH. The pier is easily deployable and is

the primary means for discharging the causeway ferries. Although this system has not been fully stressed by a flow of containers over a sustained period of time, the pier has a design goal of 12 containers per hour.[3] This rate appears achievable and is a reasonable planning factor. With this rate of discharge, 3 or 4 ELCAS piers are required to handle the 749 containers moved daily by the powered causeway lighters. Future procurement of ELCAS includes 2 turntables and 2 cranes per system, doubling productivity yet reducing deployment requirements for the total system by 60 percent.

It should be recognized, however, that in many situations, some fixed port or pier facility will be available to discharge these very shallow draft lighters (about 3 feet when loaded). Even though in-place gantry cranes will probably be denied because of their vulnerability, it is reasonable to plan on some use of shallow draft piers or barge sites for discharge of these lighters. Whatever this capability turns out to be, it will augment the capability of ELCAS piers or eventually replace them.

Terminal Service Units. Planning factors for container companies and conventional terminal service units required to handle 1,000 containers a day and 970 short tons of other cargo are difficult to determine. A single Terminal Service Company can handle the breakbulk requirement of 970 short tons per day. Assuming that most of the containers are moved across the beach via the ELCAS, the sustained rate of containers transported by the Army amphibians is only about 320 per day which can be handled by one container handling company. This means, however, that most of the loading and unloading of containers from the ferry lighters fall to the Navy's Cargo Handling and Port Group which is limited by active duty manning and requires considerable augmentation from the most obvious source—the Army terminal and the container handling companies. This situation suggests the need for cross training and familiarization with all LOTS equipment for all involved Army and Navy units. Fortunately, both services

have positioned their respective units in the same vicinity (Fort Eustis and Cheatham Annex, VA).

RO/RO Ramp. This Army/Navy team should have a capability to discharge RO/RO ships, the ideal vessels to move wheeled and tracked vehicles. Assuming that no deep-water berth or pier is available, the Navy's proposed sea state 1 ramp is the only way to discharge these specialized ships. This system is low cost and should be emphasized in testing and procurement. With the acquisition of the Sealand SL–7 ships and with their ultimate conversion to a RO-RO configuration, a means to unload this type of ships in a protected bay or in sea state 1 conditions will greatly contribute to our flexibility.

THE SYSTEM IS AFFORDABLE

Obviously, teamwork between the Army and Navy can achieve a near term LOTS capability. Both services have good equipment and workable systems now emerging from development and operational test phases. At the risk of being overtaken by some cost escalation, it is important to emphasize that a LOTS capability is affordable. Table 4–4 reflects costs for major elements of the system used to meet this notional requirement.

The final chapter of this paper summarizes the need for a Logistics Over the Shore capability and offers key recommendations for actions by senior decisionmakers.

Table 4-4: Cost Summary

Shipside	Service	Cost Per Unit (in millions of dollars)	Total Cost (in millions of dollars)
(7) Ship TCDFs or Crane Ships	Navy	$23*	$161
LIGHTERS			
(12) LACV-30 Air Cushion Lighters	Army	5.2	$ 62.4
(8) LARC LX Amphibious	Army	.8	6.4
(32) Causeway Ferries	Navy	1.2	38.4
Shoreside			
(4) Elevated Causeways	Navy	3.5	14.0
(2) Roll-On/Roll-Off Ramps	Navy	1.6	3.2
Total			$285.4

*This is the projected unit cost for the TACS.

5. WHERE DO WE GO FROM HERE?

At the beginning of this monograph a question was posed: Logistics Over the Shore—do we need it? An overwhelming reliance on sealift to sustain deployed forces clearly answers the question in the affirmative. If we lack the means to move critically needed supplies through or around damaged ports, *no* significant military operation can be supported. Airlift resources are simply too limited to deliver high tonnage on a sustained basis over a long distance.

If a LOTS capability is needed, where do we go from here? The Defense Department and the Services must recognize that the ability to discharge large amounts of cargo over the shore is a legitimate and urgent military capability. The steady conversion of our merchant marine fleet from break-bulk shipping to fewer, but larger, container ships offers serious problems to military users of the fleet.

Although the concept of containerization was pioneered by the Army, commercial transportation and distribution systems have flourished well past the military's ability to fully interface and capitalize on the full use of containers. This situation is acceptable in a peacetime situation when the vast majority of defense cargo moves through civilian ports and commercial transportation networks; however, in a wartime situation, when civilian ports are damaged or not available, we must be able to move cargo across the beach or shallow-water discharge points. Military units should have the capability to discharge these high capacity container ships under all conditions—not just the ideal situation where fixed ports are available.

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The Army, Navy, and Marine Corps are developing solutions to the problems raised in this paper. Although there is some duplication and overlap of equipment, particularly between the Army and the Navy, improvements are underway. Unfortunately, the direction of this effort has not always been clear and overall progress has been painfully slow. Each service should honestly evaluate equipment being developed by other services and should consider taking advantage of shared development and acquisition costs; and more important, each service should insure that the best and most reliable equipment is purchased.

In summary, the following key actions are recommended to build a reliable LOTS capability:

- Define a minimum LOTS requirement that supports the RDJTF. Provide a clear goal to the services.
- Refine service roles and missions for LOTS operations. The Navy should have sole responsibility for offshore discharge of container ships to Army and Navy lighters.
- Insure that force structure meets the needs of new equipment being procured. The Navy should review manning plans for the Cargo and Port Handling Group.
- Fund only watercraft and supporting equipment that directly support a LOTS requirement. Seek better use of civilian watercraft resources to meet coastal and harbor missions.
- Invest in LOTS equipment that is deployable, maintainable, and capable of sustaining high tonnage requirements. Buy equipment that will perform in rough seas and austere environments. High-tech equipment is not the answer.
- Encourage greater cooperation among the services in fielding and operating LOTS systems. Use JLOTS II in 1983–84 to build a joint capability. Two overlapping systems are not rational and will never be funded.

The above actions require leadership from the services, Joint Chiefs of Staff, and the Defense Department. The issues regarding roles and missions will be particularly difficult to resolve. However, if strong direction is not forthcoming, and a real solution to the problem is not proposed, we will still be wringing our hands, delaying programs to outyears, and planning JLOTS III ten years from now.

ENDNOTES

CHAPTER 1

1. Robin Beard, "Agenda for Defense, a Congressional Perspective," *Strategic Review*, Winter 1981, p. 13.

2. Six sea states (shown below) are used to describe wave heights. Most LOTS planning assumes that operation beyond sea state 3 is simply not practical.

Sea State	1	2	3	4	5	6
Wave Height (feet)	1	1–3	3–5	5–8	8–12	over 12

CHAPTER 2

1. *Containers in Support of National Defense,* a study prepared under the auspices of the National Defense Traffic Management Association, 29 Jan 1981, Washington, DC, p. 84(10).

2. In 1976–77 a series of Joint Logistics Over the Shore exercises at Fort Story, Virginia tested doctrinal concepts, equipment, and various subsystems of LOTS operations. The Office of the Under Secretary of Defense (Research and Engineering) issued a contract to Operations Research, Inc., Silver Spring, MD for preparing the overall test plan and documenting the results of the exercise.

3. This table is based upon data drawn from a DOD-sponsored study, *Persian Gulf Logistics-Over-the-Shore (LOTS) Support and Throughput Requirements (U)*, 28 Dec 1979, ORI, Inc., Silver Spring, MD, p. A-10.

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4. *Army Watercraft Requirements Master Plan (AWRMP)* (U), Vol I, 10 Jan 1981, prepared by Army Watercraft DARCOM/TRADOC Joint Working Group, USA Training and Doctrine Command, Fort Monroe, VA, p. vii.

5. Ibid., p. v.

6. *Better Planning and Management of Army Water Craft Could Improve Mission Capability While Reducing Excess Number and Costs*, Government Accounting Office, Washington, DC, Report Number LCD 79–419, 2 Aug 1979.

CHAPTER 3

1. Interview with Milon E. Essoglou, Director, Program Executive Division, R&D for Naval Facilities Engineering Command, Alexandria, VA, 6 Jan 1982. NOTE: Mr. Essoglou was the Navy's senior Test Evaluation and Program Manager for the Over the Shore Discharge of Container Ships Tests (OSDOC) I and II.

2. *Analysis of LOTS Requirements to Support a Non-Mobilization Contingency Situation (U)*, 5 Jan 1979, ORI, Inc., Silver Spring, MD 20910, p. 1–23.

3. Ibid., p. 1–19.

4. The mission, capabilities, and augmentation plan for the US Navy Cargo Handling and Port Group are described in OPNAV Instruction 5440.73 D (Op-414), 3 June 1981.

CHAPTER 4

1. A more detailed breakdown of container weights by class of supply is available in Table 1, *Persian Gulf Logistics-Over-the-Shore (LOTS) Support and Throughput Requirements (U)*, 28 Dec 1979, ORI, Inc., Silver Spring, MD.

2. This chart is extracted from the Army Watercraft Requirements Master Plan, 8 May 1980, Volume I, p. 1–11.

3. Operational Test and Evaluation Report on the Elevated Causeway Element of LOTS, 7 Sep 1978, Department of the Navy, Operational Test and Evaluation Force, Norfolk, VA.

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